# A STUDY TO DETERMINE WHETHER THE CALIFORNIA CRITICAL THINKING SKILLS TEST WILL DISCRIMINATE BETWEEN THE CRITICAL THINKING SKILLS OF FIRST SEMESTER STUDENTS AND FOURTH SEMESTER STUDENTS AT A TWO YEAR COMMUNITY TECHNICAL COLLEGE.

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#### **ABSTRACT**

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## American Psychological Association (APA) Publication Manual

From a historical perspective, the general public has largely accepted the claims of quality made by institutions of higher learning (Pascarella & Terenzini, 1991). Overall, the view of most individuals concerning post secondary education has been very positive. In recent years, however, the perception of higher learning has become more critical and cynical.

In response to the public=s growing aversion toward many colleges and universities, the federal government, state government, and many accrediting associations have strongly suggested, and in some cases required, that institutions of higher learning assess the educational outcomes of students to document and improve the quality of their academic offerings (Ewell, 1991).

Nicolet Area Technical College, a public community college serving approximately 1500 students annually, is located in rural Northcentral Wisconsin. The College has developed an assessment plan which proposes to determine to whether Nicolet College is fulfilling its Mission, Vision, Values, and Goals, and to refine and enhance the programs and services of the institution. The assessment plan will provide the college staff with the detailed information needed to continually improve the quality of educational programs, services, and facilities. It was decided that a major component of this assessment plan would include the assessment of critical thinking skills. The California Critical Thinking Skills Test (CCTST) was chosen as the College=s test pilot instrument for evaluating critical thinking ability. This decision was based, in part, on the CCTST manual=s description of the test which indicates the CCTST was specifically developed to measure the Askills@ dimension of critical thinking, targeting core critical thinking abilities regarded to be essential elements in a college education. The purpose of this Causal Comparative study seeks to determine if the California Critical Thinking Test will detect differences in critical thinking skills between first and fourth semester program students attending Nicolet Area Technical College.

The subjects for this study were two groups of Nicolet Area Technical College students enrolled in programs of substantial length (45 credit hours minimum). One group consisted of students enrolled in first semester classes and the other of students enrolled in their fourth semester, preparing to graduate. The first group, consisting of fifty-three students enrolled in various general education courses, were administered the California Critical Thinking Test shortly after enrollment. The second group administered the test, consisted of fifty students who had applied for graduation in December 1999. A t-Test for Independent Samples was the statistic of choice to accept or reject the null hypotheses. Null: There will be no significant difference between California Critical Thinking Skills Test scores of matriculating Nicolet Area Technical College students and those preparing to graduate.

The findings will be used to determine if this test is an appropriate measure to use in assessing the critical thinking skills of students attending Nicolet Area Technical College. Should it be found that the California Critical Thinking Test is an appropriate measure, Nicolet students, chosen at random, will be pre-tested (during enrollment) and tested again when applying for graduation.

The results of this study indicate the average mean test score of Nicolet College students enrolled in their fourth semester was significantly higher on the California Critical Thinking Skills Test (CCTST) than the average mean test score earned by first semester Nicolet College students. Additionally, there was a statistically significant increase in the mean test scores of fourth semester students on the Analysis, Evaluation, Deductive and Inductive sub-scale areas of the CCTST.

Page
List of Tables
Chapter I Introduction1
Statement of Problem
Purpose of the Study
Definition of Terms
Chapter II Review of Literature
Chapter III Design of Study
The Population
Description of the measuring Instrument
Data Collection
Statistical Procedure
Limitations
Summary
Chapter IV Results
Introduction
Data Analysis
Chapter V Summary
Summary
Conclusions
Discussion

## Contents

1 10Cautions	
Recommendations	40

## Figures

## Figure

	Page
1.	Total Critical Thinking Scores
	First and fourth semester student comparison
2.	Analysis
	First and fourth semester student comparison
3.	Evaluation
	First and fourth semester student comparison
4.	Inference
	First and fourth semester student comparison
5.	Deductive
	First and fourth semester student comparison
6.	Inductive
	First and fourth semester student comparison
7.	Percentile scores for over-all critical thinking and individual sub-scales
	First and fourth semester student comparison

#### CHAPTER I

#### Introduction

From a historical perspective, the general public has largely accepted the claims of quality made by institutions of higher learning (Pascarella & Terenzini, 1991). Overall, the view of most individuals concerning post secondary education has been very positive. In recent years, however, the perception of higher learning has become more critical and cynical. Several blue ribbon advisory panels have issued reports criticizing the quality of higher education and have called for colleges and universities to assess student performance in relation to the colleges= institutional objectives (Osterlind, 1997). According to the Wingspread Group (1993), AEducation is in trouble and with it our nation=s hope for the future@ (p.24). The report goes on to challenge the higher education community to improve the intellectual ability of its students. The spirit of this challenge is evident in the groups conclusion: AA generation ago, we told educators we wanted more people with a college credential and more research-based knowledge. Educators responded accordingly. Now we need to ask for different things. Students must value achievement, not simply seek a credential.@ (Wingspread Group, 1993, p. 24). A 20-year review into the effects of college education on student learning concluded that the evidence concerning the net effects of college on the development of general cognitive skills is minimal and rather limited in scope (Pascarella & Terenzini, 1991).

The Resource Group on Adult Literacy and Lifelong Learning (1991), states in its interim report to the National Education Goals Panel that very limited information is available on the ability of college graduates to solve problems, communicate, or to think critically.

According to Lopez (1998), Associate Director of the North Central Association of Colleges and Schools Commission on Institutions of Higher Education (NCA), public and

1

private two-year, four-year, and doctoral institutions face a major challenge in addressing the assessment of student learning.

In response to the public=s growing aversion toward many colleges and universities, federal and state governments, and many accrediting associations have strongly suggested, and in some cases required, that institutions of higher learning assess the educational outcomes of students to document and improve the quality of their academic offerings (Ewell, 1991). Studies have found that a high percentage of America=s post secondary institutions, a number as high as 82 %, have indeed initiated some form of outcomes assessment (El-Khawas, 1990). Even though there is widespread use of outcomes assessment being conducted in American higher education, there is little evidence available concerning what college students know and what skills they possess. Almost all institutions of higher learning have incorporated some form of survey or questionnaire that probes student attitudes about their educational experiences. Evaluation teams have been highly critical of this form of self reported data, however, since the surveys do not focus on what the student has actually accomplished, nor do they assess learning (Lopez, 1998).

There are various ways to assess student learning, such as standardized tests, portfolios, and locally developed tests. In choosing an assessment instrument, Lopez (1998) stressed the importance of sound methodology and measures. The instrument should measure factors the college feels students are to know, and the scores derived should be appropriate and logical inferences about student learning (Lopez, 1998).

The North Central Association of Colleges and Schools Commission on Institutions of Higher Education (NCA) is a membership organization made up of educational institutions in the nineteen-state North Central region. The association is committed to developing and maintaining high standards of educational excellence. In order for Nicolet College to be a member of the North Central Association, it has to meet all twenty General Institutional Requirements. General Institutional Requirement Number Sixteen emphasizes the importance of the Aassessment of student academic achievement including the general education component of the program and is linked to expected learning outcomes@ (AHandbook of Accreditation,@ 1997, p. 23-24). The Commission believes that the assessment of student academic achievement is imperative in evaluating overall institutional effectiveness (AHandbook of Accreditation,@ 1997).

Nicolet Area Technical College, a public community college serving approximately 1500 students annually, is located in rural Northcentral Wisconsin. The College has developed an assessment plan which proposes to determine whether Nicolet College is fulfilling its Mission, Vision, Values, and Goals, and to refine and enhance the programs and services of the institution. The assessment plan will provide the college staff with the detailed information needed to continually improve the quality of educational programs, services, and facilities. It was decided that a major component of this assessment plan would include the assessment of critical thinking skills. The California Critical Thinking Skills Test (CCTST) was chosen as the College=s test pilot instrument for evaluating critical thinking ability. This decision was based, in part, on the CCTST manual=s description of the test which indicates the CCTST was specifically developed to measure the Askills@ dimension of critical thinking, targeting core critical thinking abilities regarded to be essential elements in a college education.

3

#### Statement of the Problem

Research shows the assessment of student academic achievement is key to the improvement of student learning, in aiding educational institutions with issues related to accountability, and in documenting the importance of higher education. According to Nicolet College=s Assessment Plan (1995), critical thinking is a key element in the process of student learning. The College, therefore, has identified a need to assess critical thinking ability and is considering the California Critical Thinking Skills Test as the instrument to help it accomplish this objective. In order to make that decision, however, more information is needed to help the College determine if this test is appropriate for its population of students.

#### Purpose of the Study

The purpose of this Causal Comparative study seeks to determine if the California Critical Thinking Test will detect differences in critical thinking skills between first and fourth semester students enrolled in two year programming at Nicolet Area Technical College.

#### Null Hypothesis

There will be no significant difference in the scores on the California Critical Thinking Skills Test between students who are enrolling and students who are preparing to graduate from Nicolet Area Technical College.

#### Alternate Hypothesis

Students who are preparing to graduate from Nicolet Area Technical College will have significantly higher scores on the California Critical Thinking Skills Test than students who have just enrolled.

#### Definition of Terms

<u>General Institutional Requirements (GIR)</u>: Define institutional parameters, establish a threshold of institutional development, and mirror the North Central Association=s basic expectations of all affiliated institutions of higher education (Handbook of Accreditation [HOA],@ 1997)..

<u>Critical Thinking</u>: AThe process of personal, self regulatory judgement. This process gives reasoned consideration to evidence, context, conceptualizations, methods, and criteria @ (The American Philosophical Association Delphi Report, 1990). Thus defined as the cognitive process which effects problem-solving and decision-making.

<u>General Education</u>: Although every educational institution has it=s own definition of general education, according to the Nicolet Area Technical College Assessment Plan (1990), the mission of general education at Nicolet Area Technical College is to:

Provide an educational base of knowledge that is designed to foster customary skills, intellectual concepts and attitudes that all educated individuals should possess. General education furnishes explicit instruction in important lifelong skills needed for success in career, home, community, and the larger society. This commitment to general education is found in the essential competencies for all graduates from the college which have become known as core abilities (p.4).

<u>Core Abilities:</u> Address broad cognitive skills and perceptions that are transferrable and go beyond the framework of a specific class. Nicolet=s core abilities are: Educational program competence, solid foundation skills, effective communications, critical thinking skills, selfdirected inquiry and growth, self awareness and esteem, community commitment, and global awareness and sensitivity (Nicolet Area Technical College Assessment Plan, 1995).

The following are definitions of the five California Critical Thinking Skills (CCTST) sub-scales, as defined in the CCTST Manual, (Facione, Facione, Blohm, Howard and Giancarlo, 1998):

#### <u>Analysis:</u>

To comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgements, conventions, beliefs, rules, procedures, or criteria. Analysis also means to identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express beliefs, judgements, experiences, reasons, information, or opinions (Facione, et al., 1998, p.5).

#### Evaluation:

To assess the credibility of statements or other representations which are accounts or a description of a person=s perception, experience, situation, judgement, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representations. To state the results

of one=s reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one=s results were based; and to present one=s reasoning in the form of cogent arguments (Facione, et al., 1998, p.5).

## Inference:

To identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses, to consider relevant information and to deduce the consequences flowing from the data, statements, principles, evidence, judgements, beliefs, opinions, concepts, descriptions, questions, or other forms of representation@ (Facione, et al., 1998, p. 5-6).

<u>Matriculate</u>: To enroll, especially in a college or university, as a candidate for a degree (Thorndike & Barnhart, 1983).

<u>Substantial Length</u>: Student must be enrolled for at least 45 credit hours to be considered in an academic program of substantial length (AHandbook of Accreditation,@ 1997).

#### CHAPTER II

#### Review of Literature

#### Institutional Accreditation

In American institutions, accreditation is a uniquely voluntary process. Voluntary accreditation has two basic purposes: Quality assurance and institutional and program involvement. Institutional accreditation evaluates and accredits an educational institution as a whole. It assesses educational activities, governance, financial stability, admissions, student services, institutional services, student academic achievement, institutional effectiveness, and relationships with constituencies outside the institution (AHandbook of Accreditation [HOA],@ 1997).

Six regional agencies provide institutional accreditation, those being: Middle States, New England, North Central, Northwest, Southern, and Western. Although they function independent of one another, these six regional associations cooperate with and accept one another=s accreditation (AHOA,@ 1997).

The primary purposes of the North Central Association of Colleges and Schools Commission of Institutions of Higher Education are the public=s determination of institutional quality and the encouragement of continual institutional self-improvement. In this process, the Commission has organized the issues of institutional evaluation into broad areas called Criteria for Accreditation. It is important to note that the Commission sets high expectations for its members in all five Criteria for Accreditation areas and all of these Criteria must be to met to satisfy full accreditation requirements (AHOA,@ 1997).

Criteria 3 and 4 deal with whether the institution can accomplish its stated purposes and improve its educational effectiveness. While the Commission cannot guarantee that an institution will accomplish its purposes, it does represent the best peer judgement about the institution=s future at the time of the evaluation. In choosing to be part of NCA, an institution seeks not only external validation, but also accepts responsibility for improving educational offerings. In order to meet this criteria, it will need to have the necessary resources to maintain strengths, correct weaknesses, and respond to changing societal educational needs (AHOA,@ 1997).

In 1989, The Commission adopted its current assessment initiative. Through this initiative, educational institutions interested in learning whether they are accomplishing what they claim to be accomplishing inevitably find ways in which they can improve (AHOA,@ 1997).

Recently, the Commission has determined that an effective program for assessing student academic achievement is an imperative piece of the puzzle in support of an institution=s claims of

9

educational effectiveness. Although the measurement of learning outcomes is only one aspect of an overall effective educational program, NCA recognizes the importance of assessment data in contributing to successful decision making within an institution, especially in faculty and curriculum development. The Commission also indicated that unless an institution is prepared to integrate assessment into the institutional budgeting process, even the best plan will fail. Thus the long-range success of assessment of student learning and its ability to enhance educational quality depends on several factors including: Governing board support, appropriate leadership support, sufficient resources for ongoing assessment, funding, and an appropriate avenue for ways in which assessment information can influence institutional priorities (AHOA,@ 1997).

#### The Nicolet Area Technical College Assessment Plan

According to the Executive Summary of the Assessment Plan of Nicolet Area Technical College (1995), AThe overriding purpose of the Assessment Plan is to determine to what degree Nicolet College is fulfilling its mission, vision, values, and goals and to strengthen the programs and services of the College@ (p. ii).

Nicolet College Mission: In service to people of Northern Wisconsin, we deliver superior community college education that transforms lives and enriches communities...

Nicolet College Vision: To be a model college recognized for educational excellence and valued as a vital resource by the people of Northern Wisconsin...

Nicolet College Values: We believe in the worth and dignity of the individual, and we therefore commit to treating each person with kindness and respect. We honor individual

freedom of inquiry and individual and group contributions to governance. We value education as a life-long process. We value our students, and we strive to empower them to realize their educational goals. We value our staff and board, and we strive to support one another in our common efforts to contribute fully to the success of Nicolet College. We value our communities, and we strive to enrich them by being responsive to their needs through partnerships (Nicolet Area Technical College Catalog, 1998, p.3-5).

The Executive Summary of the Assessment Plan of Nicolet Area Technical College (1995) indicates the assessment plan will provide the college with detailed information needed to improve educational programs, services, and facilities. Nicolet College=s Assessment Plan is

linked to its mission, goals, and objectives as outlined in the following Assessment Plan goals:

- 1. Validate that programs and services are delivered as are represented by publications.
- 2. Increase the awareness and expectations for quality in all educational endeavors.
- 3. Incorporate results into future planning, policy decisions, and resource allocation.
- 4. Develop measurable outcomes and set program standards.
- Publicly promote exemplary programs and services and to increase information throughout the college district to stimulate interest and confidence in college operations.
- 6. Create a culture where stakeholders are part of and committed to improving the quality of teaching and learning at Nicolet Area Technical College.

#### Assessment

The concept of assessment has changed from one which was added on to instruction from

the outside to periodically check on its effectiveness, to a comprehensive process of continuous improvement where the use of evidence and discipline are part of the delivery of instruction itself. Ewell (as cited in IEASSA, 1994), states the whole point of assessment according to most practitioners is institutional improvement.

According to Allen, et al., (1985) an appropriate assessment program will contribute to student growth and development, resulting in increased competence, self knowledge, self esteem, and confidence. Allen stresses, that students at Alverno College have found their assessment program Ato be one of the most distinctive and powerful parts of learning@ (p.54).

For over 60 years, educational institutions have been examined in an effort to determine their effectiveness (Morgan & Welker, 1991). In the mid-1970's, numerous reports emphasized

the need for the development of excellence in the educational experience. The mid-1980's stressed increased accountability in higher education, accurate measurement of institutional effectiveness, and evidence that educational institutions were accomplishing their stated objectives. One of the main obstacles to determining institutional effectiveness has been that few colleges have common criteria for determining institutional effectiveness (Cameron, 1978).

According to a report by the Institutional Effectiveness and Assessment of Student Academic Achievement (IEASSA) (1994), there are two core indicators from the Wisconsin Technical College System which speak directly to the assessment of student achievement.

1. Identification of Student Functional Skills at Entry

The proportion of an entering student cohort for which the institution has

information describing functional skills in reading, mathematics, written and oral communication, and technical fields. Standardized or local tests administered to students at entry that include the determination of functional skills in reading, mathematics, and written and oral communication. Also desirable are tests of applied skills for students in specific technical fields (p. 4).

Basically all colleges in the Wisconsin Technical College System collect data from entering students in the areas of reading, writing, and mathematics. Applied skills are typically not assessed at entry and this is an area that, according to the Wisconsin Technical College System, needs to be further developed. It should be noted that Nicolet College does have an applied writing (essay) component.

2. Student Knowledge and Skills at Exit

The knowledge and skills achieved by students at the time of exit from college in some or all of the following areas: reading, mathematics, written and oral communication, general education and applied technology. Different methods are used at exit to collect data from students documenting knowledge and skills in basic education, general education, and applied technology. Possible methods of assessment include pre-and post-tests, portfolio performance evaluation, demonstrated competency or practical application, assessment of verbal and nonverbal communication skills, assessment of critical thinking and problem-solving skills, student description of achievement and competencies, and competency based grading (p.4).

Colleges periodically collect student outcome data at exit, especially to satisfy

13

requirements of self study for accreditation. Common practice does not exist among the Wisconsin Technical College System. Again, it has been recommended that this process be further developed (IEASSA, 1994).

Implementation of the Wisconsin Instructional Design System (WIDS) requires that all courses and programs determine competencies and/or outcomes that accompany appropriate measures of learner mastery. Outcomes must relay to learners what primary skills, knowledge, and attitudes they will learn; be measurable and observable; and require learning at the application level or higher. General education competencies and core abilities need to be measured in all courses (IEASSA, 1994).

According to the Executive Summary of the Assessment Plan of Nicolet Area Technical College, (1994), general education and core abilities are defined as follows:

The mission of general education at Nicolet College is to provide an educational core of knowledge that is intended to impart common skills, intellectual concepts, and attitudes that every educated person should possess. General education provides explicit instruction in the essential lifelong skills required for success in career, home, community, and the larger society.

Core abilities are the broadest outcomes, skills, or purposes that are addressed throughout a course or program rather than in one specific unit or lesson. Core abilities address broad knowledge, skills, and attitudes that are transferrable and go beyond the context of a specific course. Core abilities are institutional outcomes for students. Core abilities are imbedded in the curriculum and are assessed simultaneously with lesson, unit, or course outcomes (p. 4).

14

#### Critical Thinking

According to Toulmin, Rieke, and Janik, (1979), the ability to think critically is one of the most crucial survival skills in society today. The lack of these skills can keep people from participating effectively in a democratic society.

After decades of ignoring the heart of education, the eighties witnessed a growth in the process of inquiry, learning, and thinking rather than the accumulation of disjointed skills and information. Through conferences and position papers, the critical thinking movement gained momentum throughout the decade. This movement lead to the development of lesson plans incorporating critical thinking instruction in elementary, and secondary schools, as well as in college level courses in critical thinking. Critical thinking related publications and staff development programs are now major growth areas. Critical thinking is no longer characterized as a cottage industry (The American Philosophical Association, 1990).

From a historical perspective, the areas of philosophy, psychology, and education, have accepted a myriad of individual, often overlapping definitions of the words Acritical thinking.@ There seems to be as many definitions of critical thinking as there are authors on the subject. In 1987, as the need for a clear consensus definition of critical thinking became ever apparent, the Committee on Pre-College Philosophy of the American Philosophical Society (APS) began making inquires into the construct of critical thinking and its assessment. Using the Delphi methodology, a facilitator conducted an anonymous, two-year intercommunication between 46 critical thinking experts drawn from the fields of philosophy, psychology, and education. These experts, located from across the United States and Canada, did reach the first consensus definition, and this research has been called the Delphi Report (Facione, 1990).

The Delphi report was successful in identifying a specific definition for critical thinking and also in the description of a critical thinker. According to Facione, (1990), it would be impossible to understand the teaching of critical thinking without a profile of the consummate critical thinker. The Delphi Report consensus definition regarding critical thinking, as well as its interpretation of the ideal critical thinker is as follows:

We understand critical thinking to be purposeful, self-regulatory judgement which results in interpretation, analysis, evaluation, and inference as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgement was based. Critical thinking is essential as a tool of inquiry... Critical thinking is a pervasive and selfrectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, honest in facing personal biases, prudent in making judgements, willing to reconsider, clear about the issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused on inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit... (Facione, 1990)

The above definition is intended to be a guide to curriculum development and the assessment of critical thinking. For example, in applying this definition to writing curriculum for college students in specific programs, it may be helpful to substitute Aautomotive technician, or computer programmer@ in place of Aideal critical thinker@ (Facione & Facione, 1994).

The Executive Summary of the Assessment Plan of Nicolet Area Technical College (1995, p 5), identifies critical thinking skills through students possessing and demonstrating core

ability skills in the following:

synthesis	comparison
creativity	analysis
logic	skepticism
evaluation	evolution/adaptation

One of the most frequently cited reasons for the failure of education in America is the inability of American students to read and think critically. A study conducted by the National Commission on Excellence in Education reported that many 17-year-old=s do not possess the higher level intellectual abilities we expect from them. An alarming 40 % cannot draw inferences from written material and only one-fifth can write a convincing essay. Further, the Study notes that all subject matter contributes to the development of critical thinking (AA Nation at Risk,@ 1983).

It is getting increasingly more important to know how to use resources to discover new information or to problem solve in an age where access to knowledge is general and immediate (Clarke & Biddle, 1993). Clarke and Brittle, (1993) also argue that the test of today=s curriculum is to teach students to govern their own minds, and that if thinking strategies were taught and demonstrated in the academic disciplines, high school and college students could better understand the classroom experience and control and direct intellectual work. AInstructors in the academic disciplines could and should therefore teach them as surely as they teach the subject knowledge those strategies have produced@ (p.12).

Although there is agreement on the importance of critical thinking in higher education, there is debate as to how these skills should be taught (MacAdam, 1995). Talaska (1992), has compiled a number of essays by many scholars representing diverse contemporary theoretical

views of critical reasoning. He identified two central questions:

- 1. Is critical thinking a general skill apart from content or knowledge context?
- 2. Should critical thinking be taught as a skill in itself or integrated with other teaching and learning programs?

Learning must be active rather than passive. Critical thinking cannot be taught by a teacher standing at the chalk board, but must be learned by the students themselves working cooperatively or individually (Clark & Biddle, 1993).

According to Barnes, (as cited in Paul, 1992) extensive content coverage through lecture and mindless memorization combined with passive students, perpetuate lower order thinking and learning that many students currently associate with going to school. Students need to take an active role in thinking to conclusion in order to achieve higher order learning. Many students leave school with fragmentary opinions and undisciplined beliefs, leading to limited intellectual ability, morality, as well as motivational level.

#### Critical Thinking Standardized Assessment

According to the new Roget=s Thesaurus (Chapman, 1992, p. 842), a synonym for the word Acritical@ is Acrucial.@ Critical thinking skills are crucial to human development and society; therefore, developing an appropriate test to assess critical thinking is a monumentally important task, according to Ennis, (1993). Although there are many tests available that require some form of critical thinking, there are few that measure critical thinking as their primary objective. The shortage of critical thinking tests is rather unfortunate; many more are needed to fit various testing situations and purposes of critical thinking testing. In choosing a critical

thinking assessment instrument, Ennis, (1993), advises that one not depend solely on claims made by test authors and publishers; he recommends the following questions be considered:

- 1. Is the test based upon a defensible conception of critical thinking?
- 2. How comprehensive is the coverage of this conception?
- 3. Does it seem to do a good job assessing the level of your students?

There are many ways of assessing critical thinking skills including: standardized tests, locally developed (customized) tests, portfolios, essays, and performance/competency assessment. This assessment can be done longitudinally or cross sectionally (Ennis, 1993).

In terms of standardized critical thinking skills test instruments, Ennis (1993) indicated almost all are of a multiple choice format which he believes to be an advantage for institutions in terms of cost, efficiency; and time, however, he cautions that they may lack comprehensiveness. He indicated the need for additional research and development in this area.

#### California Critical Thinking Skills Test (CCTST)

According to Facione and Facione (1994), prior to the development of the CCTST there were only three test instruments available for assessing critical thinking skills at the college level. Each of these instruments however were developed based upon different theoretical constructs. This difference limits the potential for establishing concurrent validity between them.

Before the Delphi Project there was not a clear definition of critical thinking. The CCTST was the first assessment tool to derive its construct validity from this well honed definition. The CCTST first published in 1992, is an objectively scored standardized instrument that assesses the cognitive skills dimension of critical thinking. It is a timed (45 minute), 34 item, multiple choice test which, according to the manual Atargets those critical thinking skills regarded to be essential elements in a college education@(p.1). There are five scores one can obtain from this assessment instrument: an overall critical thinking score, and five sub-scores. These five sub-scores are analysis, evaluation, inference, deductive reasoning, and inductive reasoning (Facione, et al.)

According to a review by McMorris in The Twelfth Mental Measurements Yearbook, (as cited in Conoley & Impaira, 1995), The California Critical Thinking Skills Test does not have the history, reliability, or number of norm reference groups like the Watson-Glaser Critical Thinking Appraisal. McMorris felt that there was great potential for misinterpretation, as there is not mention in the manual of standard error of measurement, information on difference scores, or the need for interpretation by a qualified counselor/psychometrist. Another concern was the single college norm reference group represented by a California state college. Obviously, one would have a rather difficult time using this norm reference group to compare students at a rural Northern Wisconsin community college. In a second review, Michael (as cited in Conoley & Impaira, 1995), felt the CCTST appeared to possess substantial content validity, probably more that its competitors, due to the collective wisdom of the scholars who contributed to its development. To summarize, both reviewers had areas where they felt the test was strong, and, conversely, they felt there were also areas of significant weakness. The CCTST seems to have exceptional potential; however, as recommended, it appears that more psychometric research is needed to permit widespread use of this test instrument in both college undergraduate and graduate programs.

#### <u>Summary</u>

Critical thinking is likely to continue to be a significant component of secondary

and postsecondary education. Current literature seems to indicate that there is, has been, and continues to be debate not only on the definition of critical thinking, but on teaching/learning and the assessment of critical thinking skills as well.

The area of critical thinking is a topic that we need to continue to research. The assessment of student gains is imperative to improving teaching and learning and overall institutional effectiveness, not to mention obtaining and maintaining accreditation from the North Central Association of Colleges and Schools Commission on Institutions of Higher Education.

#### CHAPTER III

#### Design of the Study

In an effort to determine if the California Critical Thinking Skills Test (CCTST) will identify differences in critical thinking skills between first and fourth semester program students attending Nicolet Area Technical College, a causal-comparative study was conducted. The study was conducted comparing matriculating Nicolet College students and students preparing for graduation. The Null and Alternate Hypotheses follow:

#### Null Hypothesis

There will be no significant difference in the scores on the California Critical Thinking Skills Test between students who are enrolling and students who are preparing to graduate from Nicolet Area Technical College.

#### Alternate Hypothesis

Students who are preparing to graduate from Nicolet Area Technical College will have significantly higher scores on the California Critical Thinking Skills Test than students who have just enrolled.

#### Population

The sample population for this study consisted of 103 students enrolled in programming of substantial length (2 years, or 45 credits) at Nicolet Area Technical College. Of this sample, 53 were incoming (first semester) students, and 50 were students preparing for graduation. The incoming students were taking general education courses and were administered the test instrument during class time under their instructor=s direction. The other group of students were chosen at random and were required to take the examination under the direction of the Nicolet

College Assessment committee upon application for graduation.

#### Description of the Measurement Instrument

The California Critical Thinking Skills Test provides percentile ranking scores. Percentiles can be obtained for an overall critical thinking score, and/or for the following subscales: Analysis, Evaluation, Inference, Deduction, and Induction. There are three norm reference groups, including a sample group comprised of 781 college students (Facione, et al., 1998).

An alternate form method was used to calculate the reliability of the CCTST. The CCTST manual estimates the reliability to be at 0.78. Although this is less than .80 which is suggested for internal consistency on tests intended to measure a single ability, it should be noted that the CCTST assesses numerous factors (Facione, et al., 1998). According to Norris and Ennis (1990), reliability ratings of .65 - .75 are adequate on multiple factor test instruments, since on these tests there is no theoretical reason for the test items to correlate highly with one another.

According to Facione, et al., (1998), the specified domain used to determine content validity is essentially the definition of critical thinking as outlined by the Delphi group. The CCTST manual states that each of the items chosen for inclusion in the test was based upon a theoretical relationship to the Delphi critical thinking conceptualization. The CCTST manual cites several studies involving the CCTST as the primary research tool which support that the test measures precisely what it purports to measure, thus supporting its case for construct validity. The issue of face validity is addressed by the nature of the questions asked, in that s students must make judgements, draw inferences, evaluate reasoning, and justify their inferences and evaluations. Face validity was further supported by student responses to the test, by faculty committees who have adopted the CCTST as the instrument of choice for student placement, as well as, by a number of research projects examining critical thinking issues that have chosen to use the CCTST in their project. In terms of criterion validity, the CCTST has been found to correlate with college level grade point average, the Graduate Record Examination, and with SAT Verbal and Math scores (Facione, et al., 1998).

Nicolet College students will be administered Form A or Form B (equivalent forms) of the CCTST and these scores will be compared to a CCTST norm group consisting of 781 college students from a comprehensive, urban, state university. It should be noted that none of these students had completed a course in critical thinking. Their college experience ranged from completing no semester units, to completing enough units to qualify for graduation. The mean age of the students was 22 with a standard deviation of 4.457 (Facione, et al.,1998).

The CCTST manual did not provide information regarding specific reading level requirements. According to the Gamco Readability Analysis which employs the Fry Readability Formula, samples taken from random reading passages were at the 12<sup>th</sup>, 14<sup>th</sup> and 17<sup>th</sup> plus grade levels.

#### Data Collection

The California Critical Thinking Skills Test (CCTST) was given to first semester students during the month of October, 1999, as a pre-test indicator of the participants= critical thinking ability. The CCTST was also administered during the month of December 1999, to students who had essentially completed their two-year programs and had applied for graduation.

#### Statistical Procedure

This section will address the procedure that will be used in making a decision to accept or reject the null.

#### Null Hypothesis

There will be no significant difference in the scores on the California Critical Thinking

Skills Test between students who are enrolling and students who are preparing to graduate from Nicolet Area Technical College.

#### Alternate Hypothesis

Students who are preparing to graduate from Nicolet Area Technical College will have significantly higher scores on the California Critical Thinking Skills Test than students who have just enrolled.

Data taken from the California Critical Thinking Skills Test was statistically analyzed and the index of choice used to find the significance of the difference between the means of the two samples was the t-test for independent samples. The predetermined level at which the null hypothesis will be rejected, or the level of significance, will be set at .05, as according to Ary, Lucy, and Razavieh, (1985), AThe most commonly used levels of significance in the field of education are the .05 and .01 levels@ (p.155). At the .05 level of significance, the null hypothesis will be rejected only if the estimated probability of the observed relationship being a chance occurrence is five in one hundred, thus greatly limiting the chances of committing a type I error (Ary, Lucy, & Razavieh, 1985).

#### Limitations

This study is limited by the geographical area of the population used in the study. Students involved in the study were mainly from rural Northcentral Wisconsin. Caution should be taken when generalizing the results of this study with other geographic areas.

#### Summary

Historically, people have, in general, accepted the premise that attending a college or university would result in an improvement in one=s ability to think critically. The trend recently however, has taken a more cynical turn, as students are graduating from post secondary institutions of higher learning without possessing the basic life skills necessary to obtain and maintain employment. Governing agencies such as the North Central Association of Colleges and Schools Commission on Institutions of Higher Education have responded to these concerns and have set forth specific criteria for measuring core abilities. In examining ways to assess these broad cognitive skills, many colleges and universities have adopted entrance/exit testing procedures, including the assessment of critical thinking skills.

Nicolet Area Technical College=s Assessment committee has expressed a desire to adopt an assessment program to measure student outcomes related to core abilities. Part of this plan seeks to address critical thinking skills. This study was devised to aid Nicolet College in determining whether the California Critical Thinking Skills instrument would be an appropriate measure for assessing the critical thinking growth provided through the Nicolet College experience.

#### CHAPTER IV

#### Results

#### Introduction

The purpose of this causal-comparative study was to test the following null hypothesis: There will be no significant difference in the scores on the California Critical Thinking Skills Test (CCTST) between matriculating students and students who are preparing to graduate from Nicolet Area Technical College.

The subjects for this study were 103 Nicolet Area Technical College students. Fifty-three of which were first semester (incoming) students and 50 were fourth semester (outgoing) students. These students were administered the California Critical Thinking Skills Test. Critical thinking scores were obtained in six areas on the CCTST. These scores consisted of an over-all critical thinking score and five sub-scale scores in the areas of analysis, evaluation, inference, deductive reasoning, and inductive reasoning. The first three scales-analysis, evaluation, and inference-make up a major portion of critical thinking theory as identified by the Delphi group (Facione, 1990). The last two-inductive and deductive reasoning-are more traditional critical thinking characterizations.

#### Data Analysis

Since the purpose of this study focused on whether the CCTST would discriminate between the critical thinking skills of students attending Nicolet College enrolled in their first semester and those enrolled in their fourth semester, a statistical analysis was conducted on the total mean scores of these two groups. The following data was compiled using a t-test for independent samples.

The null hypothesis was rejected and the alternate hypothesis was accepted by this researcher. To determine significance, the probability level was set at the .05 level. It was

found that the CCTST mean score for the group of students who were preparing to graduate from Nicolet College (14.06) was significantly higher than the scores on the CCTST obtained by students who were in their first semester (11.21), (t-value of 3.87, df = 101, p<.05). (see Figure 1).

#### Figure 1

## Total Critical Thinking Scores on the California Critical Thinking Skills Test for First and Fourth Semester Comparison



#### **Mean Score**

While not having been addressed by the null hypothesis, as an area of interest to this researcher, data analysis was done on the five sub-tests of the CCTST. Again the level of significance was set at .05 for the t-value analysis of each sub-scale.

It was found that there was a statistically significant difference in the total mean test scores between first and fourth semester Nicolet College students on the California Critical Thinking Skills Test in the Analysis Sub-scale (see Figure 2).

## Figure 2





There was a statistically significant difference between the total mean test scores of first semester students and fourth semester Nicolet College students on the California Critical

Thinking Skills Test - Evaluation Sub-scale (see Figure 3).



## Evaluation



Although it was found that there was a difference between the total mean scores of first semester students and fourth semester Nicolet College students on the California Critical

Thinking Skills Test - Inference Sub-scale, this difference was not statistically significant (Figure 4).

## Figure 4





There was a statistically significant difference between the total mean test scores of first

and fourth semester Nicolet College students on the California Critical Thinking Skills -Deductive Sub-scale (Figure 5).

## Figure 5

## Deductive



A statistically significant difference was found between the mean test scores of first semester and fourth semester Nicolet College students on the California Critical Thinking Skills Test - Inductive Sub-scale (see Figure 6).



Figure 6

Additional information that may prove helpful in further defining the critical thinking abilities of first and fourth semester Nicolet College students, as assessed by the California Critical Thinking Skills Test, was obtained by comparing student raw scores to a norm group representation derived from the California Critical Thinking Skills Test Manual (Norm Group 1). This norm group consisted of 781 college students enrolled at a comprehensive, urban state university. None of the students in this norm group had completed a formal critical thinking course and were typically of junior standing, although some had completed no collegiate work and others were qualified for graduation (Facione, et al., 1998, p. 10). The percentiles in Figure 7 were obtained by converting Nicolet College student total raw scores to percentiles based upon a comparison to this norm group.



Percentiles

According to Figure 7, Nicolet College student=s critical thinking skills are typically below the average mean scores of the norm group represented by the test publisher. Chapter V

#### Summary

Historically the general population has accepted claims made by institutions of higher learning regarding the value of higher education. Today, however, students, parents, employers, accrediting institutions, and colleges are questioning whether students are getting real value for their money, (i.e. Are students receiving what has been promised to them in terms of a quality education?) In an effort to n=53 substantiate claims of quality, the Wisconsin Technical College

System has instituted an educational guarantee called the Guaranteed Retraining Policy. This policy states that:

The Wisconsin Technical College System guarantees up to six free credits of additional instruction within the same occupational program to Wisconsin graduates of a vocational diploma or associate degree program if: Within 90 days after initial employment, the graduates employer certifies to the District Board that the graduate lacks the entry-level job skills and specifies in writing the specific areas of deficiency (Nicolet Area Technical College Catalog, 1998, p.7).

In order to define and measure student learning, improve the teaching and learning process and overall institutional effectiveness, and to meet Northcentral Association (NCA) accreditation mandates, Nicolet College has formed an Assessment Committee. One of the initial charges of this committee is to identify and determine the appropriateness of various assessment procedures and instruments for use in the Nicolet Assessment Program. Because NCA has identified critical thinking as an important factor to consider in assessing student learning, this study was undertaken to aid Nicolet College in selecting an appropriate instrument for assessing students= critical thinking skills. Conclusions

The results of this study indicate the average mean test score of Nicolet College students enrolled in their fourth semester was significantly higher on the California Critical Thinking Skills Test (CCTST) than the mean test score earned by first semester Nicolet College students.

Through additional research, it was found that on the five (CCTST) sub-scales, the total mean scores of fourth semester students were significantly higher than those of first semester students, with the exception of the Inference Sub-scale. It should be noted that although a statistically significant difference between the scores of first and fourth semester students was not found on the Inference sub-scale, this sub-scale did yield a higher mean score for the fourth semester students.

Although the overall mean test scores for Nicolet College students was below that of the test publisher=s norm group most closely representing Nicolet College students (Group 1), there are some fundamental differences among these two groups of college students that need to be addressed. The Group 1 test norms consist of college students attending an urban four-year, liberal arts university located in California, as opposed to Nicolet College which is a small, rural, Midwestern, community technical college . Additionally, most of the students in Norm Group 1 are reported to be of junior (5-6 semester) standing, whereas Nicolet students were in their 1<sup>st</sup> or 4<sup>th</sup> semesters. This research could however indicate that although there was an improvement in critical thinking ability between 1<sup>st</sup> and 4<sup>th</sup> semester Nicolet College students, there may be

room for further growth.

#### Discussion

In related research done by the author of the CCTST, four quasi-experimental studies were conducted to explore the attributes of the CCTST. A pretest/posttest, case/control study design was utilized to gather data to determine the CCTST=s validity and reliability, to assess instrumentation effects, and to measure student gain scores after a course in critical thinking. Cases were students enrolled in one of four course offerings in critical thinking. Controls consisted of students who had not taken a critical thinking course, but took the course AIntroduction to Philosophy.@ The total number of students participating in the study was 1673. Like the Nicolet study, the test was administered in college classrooms within a 45-minute time frame. Results of this study indicate that significant gains in the CCTST total score were observed in the case group (students who took a critical thinking skills course) as compared to the control group who took the course AIntroduction to Philosophy@ (Facione & Facione, 1994).

If it is the goal of Nicolet College to improve student critical thinking abilities, this research would seem to suggest that Nicolet College may want to identify current critical thinking courses, adapt curriculum and incorporate at least one of these classes, or at minimum, infuse portions of these identified courses into the core program curriculum to ensure that critical thinking skills are a part of all the Nicolet College educational offerings. Another possibility would be to require that all Nicolet College students take an actual critical thinking course.

In somewhat conflicting research, Harris and Clemmons, (1990), conducted a study to determine an appropriate test of critical thinking to screen college freshman. The study took place at a comprehensive university with an enrollment of 14,000 students. Matriculating students with entry level test scores in English, math, and reading below certain cut scores were required to engage in remedial instruction. This remedial program of study included a mandatory three semester hour critical thinking course. Through preliminary research, it was found that the Watson Glaser Critical Thinking Appraisal (WGCTA) and California Critical Thinking Skills Test (CCTST) met their standardized test requirements. If either test proved to be a good predictor, it would possibly be used as a placement test allowing students to Atest out@ of the critical thinking course. Prediction was based upon the extent to which students scoring above the median on the pre-test were also above the median on their overall course grade (Harris & Clemmons, 1996).

To help minimize variables, all sections of the course were taught by the same professor using the same lesson plans, course materials, and course evaluations. A comparison between pre-test scores and course grades was then made. Fifty percent of those who placed above the median on the CCTST pre-test, and 61.5 of those who placed above the median on the WGCTA pre-test, also completed the course above the median. The difference of the mean scores for both the CCTST and the WGCTA were found to be statistically insignificant, suggesting that the course had little effect on the students= critical thinking abilities.

With only half (CCTST) or slightly more than half (WGCTA) of those above the median on the pre-test also in the top half in terms of course grades, the notion that doing well on the pre-test indicates a likelihood of doing well in the course is reduced to about

the same odds as a coin-toss.

Because of the results of the study, the university did not feel confident that either test was appropriate for placement purposes, therefore they chose to delay making a decision regarding a critical thinking skills screening assessment instrument until further research is conducted (Harris and Clemmons, 1990).

In regards to the above study, and of particular interest to this researcher, was the mean score for the developmental students on the CCTST of 10.9. While this score is significantly below the mean of the norm group reported by the CCTST test publisher (15), it is important to note that this norm group probably did not include a significant number of students enrolled in remedial education. This researcher was not surprised, therefore, to see a mean score significantly below that reported by the test publisher. Also, because these students were in remedial education, one would question whether many of them possessed the reading level necessary to comprehend the CCTST. As noted in chapter III of this study, according to the Fry Readability Formula, the CCTST contains passages written at the 17<sup>th</sup> grade level equivalent. An additional factor for consideration regarding this study was the relationship between course content and content of the tests. Was the content of these tests the same, or at minimum, highly similar to what was being taught in the critical thinking course? If not, this study basically compared apples to oranges.

#### Precautions

In terms of the Nicolet study, there were several confounding variables which should be addressed, since they may have had an impact on the findings of this study. These potential limitations include:

- \$ Students not taking the test seriously (random guessing).
- \$ Limited sample size.
- \$ The use of a single assessment instrument to assess critical thinking ability.
- \$ Outside factors that may be influencing a growth in critical thinking ability, such as maturation, employment, health, major life changes, etc.
- \$ One may be an exceptional critical thinker at college entrance, therefore there may not be a significant amount of growth in this area as a result of the Nicolet College educational process.
- \$ The lack of an improved score on the critical thinking examination may, or may not, be the result of a poor or ineffective test instrument.
- \$ Limited geographical area of the population used in this study.
- \$ Through the process of attrition, students ill-prepared for the rigors of post-secondary education either drop out or fail. In all likelihood, some of these students were part of the first semester group. There is a high probability that students who make it to the fourth semester are good students, possessing at least a moderate level of critical thinking ability, thus emphasizing the importance of pre-and post-testing the same students.
- S The CCTST requires a rather high reading level, up to and beyond the 17<sup>th</sup> grade equivalent; therefore, it is possible that students who took this test instrument may not have had the reading ability necessary to comprehend some of the reading passages.
- \$ The test starts out with items that appeared to be very difficult. According to many student responses, the test=s first question seemed extremely difficult, which fostered negative

40

feelings almost immediately, causing several students to simply quit or guess. It would seem that a transition from basic to more complex material would have been more appropriate.

\$ According to several students taking the test, the literary topics were not very interesting, especially to the typical student enrolled in technical college programming. The test, therefore, seemed to be better suited to liberal arts students.

#### Recommendations

Considering the preceding study results, related research, and precautions, the following recommendations are made for consideration in the adoption of a critical thinking skills assessment instrument for use in a program designed to pre/post test students at Nicolet College.

1. Further research should be conducted to include a greater population of Nicolet college students. Ideally, this study could be cross-validated by the testing of students throughout the Wisconsin Technical College System for comparison purposes.

2. For the sake of expediting the study, incoming and exiting students were assessed concurrently and inferences regarding growth in critical thinking were then made. It seems that a more valid research method for measuring growth in critical thinking ability would be to conduct a longitudinal study pre-and post-testing the same sample of students.

3. Although research determined the California Critical Thinking Skills Test did discriminate between the scores of first and fourth semester Nicolet College students, further research is warranted using additional critical thinking assessment instruments, such as the Watson Glaser Critical thinking Appraisal and Cornell Critical Thinking Test. Comparisons should be made and a recommendation for adoption of the most appropriate test for

41

assessing Nicolet College students should then be made based on this data.

4. In light of the Nicolet College Mission Statement which stresses the delivery of Asuperior community college education,<sup>@</sup> Nicolet may want to consider developing a course specific to critical thinking to further develop it=s students critical thinking abilities. This course could be a requirement for all program students, or identify critical thinking type courses taught at Nicolet College, and if students are not mandated to take one of these courses, infuse critical thinking components from these courses into all program curriculum.

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